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ABSTRACT

This empirical study compared a graduate online course with an equivalent course taught in a traditional face-to-face format. Comparisons included student ratings of instructor and course quality; assessment of course interaction, structure, and support; and learning outcomes such as course grades and student self-assessment of ability to perform various Instructional Systems Design (ISD) tasks. Results revealed that the students in the face-to-face course held slightly more positive perceptions about the instructor and overall course quality, although there was no difference between the two course formats in learning outcomes. The findings have direct implications for the development and delivery of online instruction. (Contains 16 references.) (Author/MES)

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Comparative Analysis of Online vs. Face-to-Face Instruction

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Abstract: This empirical study compared a graduate online course with an equivalent course taught in a traditional face-to-face format. Comparisons included student ratings of instructor and course quality; assessment of course interaction, structure, and support; and learning outcomes such as course grades and student self-assessment of their ability to perform various Instructional Systems Design (ISD) tasks. Results revealed that the students in the face-to-face course held slightly more positive perceptions about the instructor and overall course quality although there was no difference between the two course formats in learning outcomes. The findings have direct implications for the development and delivery of online instruction.

1. Introduction

New advances in Internet-based technology have brought challenges and opportunities to education and training, particularly through online instruction. While online instruction is gaining popularity, it is not free from criticism. Many educators and trainers do not support online instruction because they do not believe it actually solves difficult teaching and learning problems (Conlon, 1997). Concerns include the changing nature of technology, the complexity of networked systems, unstable online learning environments, and the limited understanding of how much students and instructors need to know to successfully participate (Brandt, 1996). Online instruction also threatens to commercialize education, isolate students and faculty, reduce standards, and devalue university degrees (Gallick, 1998). While these concerns may be unwarranted, there is little research to fully understand the benefits and pitfalls of online instruction, especially when compared to face-to-face learning environments. Gaining knowledge about the processes and outcomes of online instruction as compared to face-to-face environments will help educators make more informed decisions about future online course development and implementation.

1.1 Problem Statement

Although the popularity of online programs has increased in recent years, the capabilities and efficacy of such programs have yet to be fully investigated. Most effort in this area has been devoted to program development and much of the research has anecdotal in nature. With little empirical knowledge of Internet-based education outcomes, the need for research in this area is not only timely, but also imperative. The primary purpose of this study was to compare an online course with an equivalent course taught in a traditional face-to-face format. Comparisons included student ratings of instructor and course quality; assessment of course interaction, structure, and support; and learning outcomes such as course projects and student self-assessment of their ability to perform various ISD tasks.

1.2 Research Questions

This study was designed to answer the following research questions:

1. What differences exist in satisfaction with the learning experience of students enrolled in online vs. face-to-face learning environments?

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2. What differences exist in student perceptions of student/instructor interaction, course structure, and course support between students enrolled in online vs. face-to-face learning environments?
3. What differences exist in the learning outcomes (i.e., perceived content knowledge and quality of course projects) of students enrolled in online vs. face-to-face learning environments?

2. Background

There are many assumptions about Internet-based education, most of which are positive and optimistic (Relan & Gillani, 1997). The many challenges associated with creating meaningful learning environments via the Internet (Hill, 1997) include how to meet the expectations and needs of instructors and students and how to design courses so they provide a satisfying and effective learning environment. From program developer and instructor perspectives, understanding these issues is critical for the development and implementation of quality online instruction.

While few experimental studies have compared the effectiveness of online instruction to the more traditional face-to-face offering, two recent studies provide encouraging results for developers of online instruction. Schutte (1997) conducted a small scale experiment in which he divided a class of 33 students into a traditional section and a virtual section taught on the World Wide Web (WWW). Schutte's results showed that instruction provided online can result in improved performance. LaRose, Gregg, and Eastin (1998) conducted a similar study that compared the learning outcomes of students in a traditional lecture section to course section that provided pre-recorded audio via the WWW along with detailed course outlines and related course pages accessed on the Web. Results showed that the Web group had test scores and student attitude ratings equal to those of the traditional section. While these types of quasi-experimental studies present methodological challenges (e.g., dealing with small sample sizes, the effect of prior knowledge, etc.), they do provide an important first step into better understanding the effect of online instruction on learning outcomes and student satisfaction.

3. Method

3.1 Subjects and Instructional Setting

This study compared outcome data obtained from students enrolled in one of two versions of a graduate level instructional design course for human resource professionals. One version of the course was taught using a traditional face-to-face format while the other version of the same course was offered totally online, with no direct face-to-face contact between the instructor and the students. Both courses were taught by the same instructor using the same content, activities, and projects. Nineteen students, most of whom are pursuing a graduate degree in HRD, were enrolled in the on-campus course. Nineteen students were also enrolled in the online version of the course. These students are also pursuing a graduate degree in HRD through a degree program that is taught completely online.

3.2 Instrumentation

The *Course Interaction, Structure, and Support* (CISS) instrument was used to assess student's perceptions of the quality of various instruction-related variables. This instrument is a hybrid of the *Distance and Open Learning Scale* (DOLES) and the *Dimensions of Distance Education (DDE)* (Harrison, Seeman, Behm, Saba, Molise, & Williams, 1991; Jegede, Fraser, & Curtin, 1995). CISS consists of 11 items for the dialog construct, 8 items for support, 8 items for course structure, and 4 items for transactional distance.

3.3 Procedures

All data were collected at or near the end of the semester. The on-campus students completed paper versions of the instruments while the online students completed equivalent online version of the instruments. All instrument

data were entered into a statistical analysis package for later analysis. Statistical analysis was conducted using independent sample *t*-tests with a significance level of .05.

The search for differences in learning outcomes between students enrolled in the online vs. face-to-face learning environments was conducted using two primary sources of data. The quality of a major course project was the first indicator of learning outcomes. Students in both courses were required to complete a training package that included all training materials and instructional aids as well as all student materials needed to conduct the training. A blind review process was used to evaluate the quality of the course projects. Three HRD doctoral students with instructional design experience were asked to independently evaluate each project in terms of the presentation quality, course organization, degree of detail provided, and overall quality. The reviewers were not told that the purpose of the review was to compare the two course formats and they did not know which projects came from online or face-to face sections. The reviewers rated each project on a four-point scale for each of the four quality characteristics. Analysis of variance was used to examine ratings of the projects using a significance level of .05.

A self-assessment instrument was also administered at the end of the course. This instrument asked students to rate their level of comfort at performing various ISD tasks. A total of 29 items were developed from the course objectives. Individual *t*-tests were conducted to examine differences between the groups on each of the task items.

4. Results

The following results are from comparisons of the face-to-face and the online students' perceptions in the areas of satisfaction, course interaction, course structure, and support. Further analysis compares student learning outcomes in terms of course project quality and a self-assessment of their ability to perform various ISD tasks.

4.1 Student Satisfaction

Student satisfaction was assessed using two items on the CISS instrument that corresponded to the global items used by the university to evaluate all campus courses. These items asked students to rate, on a five point Likert scale (5 = exceptionally high rating), the overall quality of the instruction and the course.

Both groups provided positive ratings, although the face-to-face group displayed more positive views than the online group. The instructor's overall teaching effectiveness received a mean rating for the face-to-face group of 4.21 (SD = .79) while the online course mean was 3.58 (SD = 1.07). A similar, though non-significant, difference was found for the overall course quality rating, with the face-to-face group (M = 4.32, SD = .73) providing a slightly more positive rating than the online group (M = 3.79, SD = .92), $t(36) = 1.94$, $p > .05$.

4.2 Perceptions of Course Interaction, Structure, and Support

The CISS instrument assessed student perceptions regarding course interaction, structure, and support throughout the semester. Using a four point Likert scale, the students indicated the degree to which they *Agree* (4) or *Disagree* (1) with various statements. Overall, both groups of students had positive perceptions, with the face-to-face students having significantly more positive views for interaction and support.

4.2.1 Student Interactions

Interaction among the students was assessed using 5 items that represented characteristics of a learning environment that support student communications, shared learning experiences, teamwork, building a sense of community, and promoting an increase in student contacts. As shown in Table 1, there was a significant difference in the between the two course formats, $t(33) = 3.847$, $p < .05$.

Students enrolled in the traditional face-to-face course had a more favorable opinion of the amount and type of interactions among the students. Analysis of the individual items revealed no difference in the amount of contact among the students but a significant difference in terms of communication with other students in the class, sharing learning experiences with other students, perceptions of a sense of community, and being able to work in teams.

4.2.2 Student & Instructor Interactions

There was a difference in the perception of interaction between the instructor and the students as assessed using items covering teaching style, interaction with the instructor, instructor feedback on student progress, and the instructor's treatment of the students. Analysis of the individual items revealed a significant difference relating to students being informed about their progress in the course, student and instructor interactions during the course, and the treatment of the students in the course, with a lower rating by the online students.

CISS Instrument Sections	Face-to-Face*	Online*	*t*
Student Interactions	3.23 (.51)	2.65 (.37)	3.847**
Student & Instructor Interactions	3.11 (.49)	2.74 (.41)	2.455**
Course Structure	3.16 (.41)	2.94 (.40)	1.641
Instructor Support	3.17 (.43)	2.75 (.53)	2.690**
Departmental Support	2.15 (.56)	2.66 (.46)	-2.921**

Note. *Group means determined using a 4 point Likert scale ranging from Strongly Agree (4) to Strongly Disagree (1). Mean value above 2.5 indicates a positive perception among the students. A positive *t* value indicates a more positive perception among the face-to-face students. Standard deviations in parentheses.

**$p < .05$

Table 1: Perceptions of Course Interaction, Structure, and Support.

4.2.3 Course Structure

There was no difference in the variable that examined issues of students being allowed to work at their own pace, quality of the course syllabus, structure of class activities, organization of the content, student input in the topics selection, teaching methods, and student assessment.

4.2.4 Instructor and Departmental Support

Instructor support included comprehensiveness and usefulness of feedback, student encouragement, and the instructor being able to help students identify problem areas with their studies. The students in the face-to-face course rated the instructor significantly higher for instructor support than the online students. Analysis of individual items showed no difference in the amount of encouragement the instructor provided to the students. These differences relate to the characteristics of instructor feedback and the ability of the instructor to assist students to identify weaknesses in their course preparation.

Departmental support included information the department provided to the students, inquiring about their learning needs, and providing a communication link between the students and the instructor. The online students rated the departmental support significantly higher than the students enrolled in the face-to-face course. Analysis of individual items showed no difference in the departmental staff inquiring about the student satisfaction with the services provided and the departmental staff serving as facilitators between the instructor and the students. The differences related to students being informed about the support services, and about their learning support needs.

4.3 Student Learning Outcomes

Although student perceptions are important, the ultimate indicator of course effectiveness is the degree to which students reach the objectives. The following analysis examines differences in the quality of the final course projects and a comparison of the students' self-assessment of their ability to perform each element of the ISD process.

4.3.1 Blind Review of Course Projects

A primary outcome of the instructional design course was the completion of a complete training package that served as evidence that students had gained the knowledge and skills required of instructional designers. Since some of the students choose to work together on this project, the number of projects produced does not match the class enrollments. A blind review process was used to evaluate the quality of the course projects to compare the outcomes across the two course formats.

Overall, the thirty projects were rated very favorably (M = 3.43, SD = .60). The overall mean rating of the face-to-face class projects was 3.47 (SD = .60) and the mean rating for the online class projects was 3.40 (SD = .61). The difference in the project ratings for the two groups was not significant.

4.3.2 Self-Assessment

A self-assessment instrument assessed students' reported levels of comfort at performing various instructional design tasks. Each task was rated on a four point scale from Very Comfortable (4) to Very Uncomfortable (1). Significant differences were found on only five of the 29 items on the self-assessment instrument. The online group felt more comfortable than the face-to-face group when distinguishing among various ISD models while the face-to-face group felt more comfortable performing a learner analysis, preparing a content analysis, writing instructional goal statements, and writing terminal objectives in comparison to the online group upon completion of the course.

5. Discussion

As discussed in the opening sections of this paper, the effectiveness of online instruction is unclear. The results of this study show that student satisfaction with their learning experience tends to be slightly more positive for students in a traditional course format although there is no difference in the quality of the learning. These results suggest that online instruction can be as effective as traditional face-to-face instruction.

Students from both groups provided positive ratings of the instruction and the course. Although the face-to-face group provided a slightly more positive rating of instructor quality than the online group, the reasons for this difference are not evident. It is possible that the instructor was more effective in the traditional format, although the lack of difference in the learning outcomes does not support this. Another possible explanation is that student ratings may be higher when there is a personal connection between the instructor and the students, something that may not occur in an online course. Another possibility is that the response set of online students tends to be lower than the response set of students in a traditional format. Clearly, additional study of the influence of online instruction on student ratings is needed.

Generally, the face-to-face students indicated a more positive perspective on the learning environment characteristics than the online students. Considering the fact that the face-to-face class met in person once a week for a 3 hour period throughout the semester, the differences in student interaction levels are to be expected. Students in face-to-face courses can more easily get together for an extended period of time to discuss class projects, work out any differences of opinion, and build social relationships. In contrast, online students do not have similar opportunities, although the technology provides a surrogate form for similar interactions. This suggests that the online environment may lack the strong social dimension that is beneficial to face-to-face classroom experiences.

Differences between the online and face-to-face groups were significant for instructor and departmental support. Students in the face-to-face course reported higher levels of instructor support than did the online students. A more detailed item analysis reflected that the differences stemmed from the characteristics of instructor feedback. This makes sense in view of the differing contexts of the two classes. The face-to-face setting allowed the instructor to vary the nature and type of feedback as needed. In the online course however, the instructor feedback was limited largely to e-mail, fax, uploaded files, and periodic telephone conversations as a means of delivering feedback. The face-to-face students received live and dynamic forms of support from the instructor while the online group received support in a form of one way static communication. In terms of departmental support, the online students reported higher ratings than the face-to-face students. This difference is easily explained by the fact that the face-to-face class had direct contact with the instructor and a part time teaching assistant, therefore they had little need for support from the department. In contrast, given the complexities of online technologies, the online class had more need for technical support, a service that was provided by the department.

The lack of difference in the learning outcomes from the two course formats supports the continued development of online programs. Using a blind review process to judge the quality of the major course projects, the ratings of three independent reviewers showed no difference in the quality of the projects across the two course

formats. While there were significant differences on five of the 29 self-assessment items, examination of the results as a whole indicate the students in both groups are equally comfortable in performing the instructional design tasks. Four of the sets of means fell between the "comfortable – very comfortable" range and one set of means fell between the "uncomfortable – comfortable" range. Overall, both groups indicated a level of comfort at performing the tasks. It is worth devoting some discussion as to why these few differences did exist.

5.1 Implications for Future Online Programs

The ultimate question surrounding online instruction is whether or not it is as effective as traditional face-to-face modes. The findings of this study show that online learning can be as effective as face-to-face learning in spite of the fact that students in online programs are less satisfied with their experience than students in more traditional learning environments. In view of these findings, several implications emerge pertaining to future online programs.

First, this analysis suggests that the development and use of online programs should continue. Further examination of feedback and student progress are needed to improve overall student/instructor communication. This includes identifying and implementing new communication measures to facilitate student/instructor communication at appropriate points in the course. Second, a better understanding of why online learners report lower levels of comfort with their learning is needed so specific strategies for improving delivery of online programs that increase student confidence levels can be developed. Finally, educational practitioners who may enroll in or develop online courses need to be familiar with the limitations of online programs. Such an awareness will ensure that the expectations of learners are met and the intended course goals can be attained. For instance, the findings in this study suggest that online instruction may not be suitable for courses that require high degrees of student instructor interaction and feedback, such as performance-based training methods courses that rely on considerable mentoring and coaching. Until the technologies for online instruction better simulate real time interaction, program developers need to avoid courses that require frequent socialization between students and the instructor.

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